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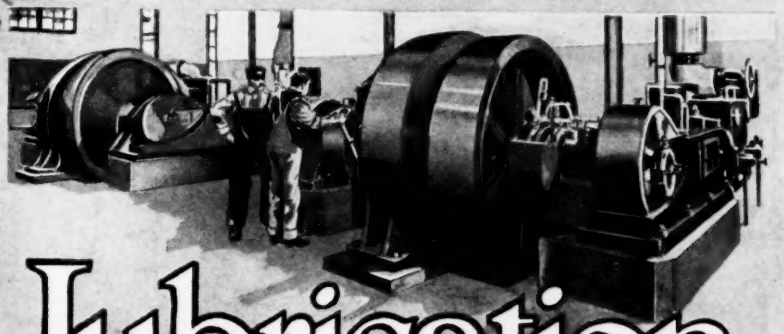

Lubrication

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FLASH and FIRE TESTS, and their value in selecting lubricating oils

A Year of Texaco Service

A Twelve Month Gas Engine Performance

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EDITORIAL

There is always a tendency wherever the buying for any class of equipment is to be carried out thoroughly, to create specifications so that the buyer can be assured of the products, which are offered, meeting his requirements, and the prices which are made being based upon such a condition. It is, of course, desirable in all buying, wherever possible, that the competition should be as wide as may be, so that the buyer will be able to secure whatever advantage may arise from such competition. Moreover, if it can be done, it is desirable that specifications should be made up which will indicate the kind of equipment of value to the user.

However, specifications are only to be desired where they actually suggest the values which the user requires and will allow him to measure the character of equipment and its suitability for his purpose. In any other case, a specification is apt to be misleading, and may be detrimental, because it will not protect the buyer as to the value of the product for his purpose, and it is quite likely to limit his competition because of that fact. In the buying of printed matter, for instance, specifications may be drawn up giving the weight and texture of the paper, the character of the composition, colors, sizes, etc., but so much depends upon the workmanship, so much of the value is expressed in the methods used by the printer, that when the specification is all made it is possible to secure prices varying as much as 50 per cent on the same job and the results of the work will be almost in accordance with the price. One printer can easily use the same stock, the same colors, the same type, and still produce a piece of printed matter, which is worth less than half the final production of another printer, whose workmanship is more in accordance with the requirements.

In the buying of oil the situation on specifications is even worse, because the value of oil from a lubricating standpoint is governed entirely by the mechanical conditions under which it is to operate, and no set of laboratory specifications can be made to indicate the precise mechanical conditions which obtain, or the value which the lubricant will have in meeting these requirements.

With the single exception of the viscosity test, the physical characteristics of a lubricating oil have little or no bearing upon its value under working conditions, and this test is only of importance when the oil buyer is thoroughly acquainted with the characteristics of the different crude oils, is able to determine the crude from which the lubricating oil is made, and is so familiar with lubricating engineering that he can be sure that the mechanical conditions call for the use of an oil of the particular viscosity stated.

Even when all is said and done, it is possible to produce two oils answering practically the same physical tests in the laboratory, which are entirely different in their action under working conditions. This means that the specification of a particular set of tests in the buying of oil is absolutely no protection to the buyer in regard to the value of the product, and consequently the chief purpose is lost and the specification will probably have the effect of limiting competition, because of the fact that only oils from certain crudes will meet it; so that the buyer may be discriminating against himself by making it impossible for refiners to offer oils which have proved to be of the greatest value for the purpose.

If there were any way of expressing in a specification the ability of oil to withstand the pressure between the metal surfaces so as to maintain a proper film sufficient to keep them apart; or if there were any way to limit the internal friction of the oil itself to the proper requirement, some specification might be made up which would have a bearing upon the value of the oil in its work. As it stands, at present, however, none of the specifications which are used in the buying of lubricating oil indicate the value of the oil itself, and they are likely to be more of an embarrassment to the man who would use the product than a benefit.

The only method of determining the relative values of lubricating oils to the buyer for his own protection, is the actual testing of the oil under the mechanical conditions to which it will be subjected in daily operations, so that a comparison of consumption, frictional heat, power requirement, etc., can be made. In other words, the practical engineering test on the bearing or in the cylinders of the unit to be lubricated is the logical and in fact the only valuable method of discriminating between lubricating oils offered for the purpose.

It is for this reason that The Texas Company is prepared at all times, and in fact, urges upon all oil buyers, the testing of its lubricating oils under the working conditions in comparison as to service, and it is upon the result of this method of testing that it secures and maintains its wide and growing business in lubricating oils for all classes of work.

A TWELVE-MONTHS GAS ENGINE PERFORMANCE

The results secured in a large middlewestern plant in a year's work with Texaco Service are typical of the general effect of this lubricating work wherever it is introduced.

In this plant there are two Allis-Chalmers gas engines operating on producer gas. These units are 24x36 of 750 I. H. P. each, operating at 150 R. P. M. and directly connected to D. C. generators.

The lubrication of the cylinders, stuffing boxes, and exhaust valves is accomplished by Richardson Type M, 8 feeds, force feed lubricators, 2 to each unit, or 16 feeds to each engine.

The external lubrication is by gravity circulating system of 20 barrels capacity, filtration by White Star filters. The system is arranged in duplicate, each filter being of ample capacity to take care of external lubricating requirements during the period of cleaning.

Prior to the introduction of Texaco lubricating service, two oils were used for these units, one oil being used entirely for internal lubrication and the other oil for the circulating system only.

During this time it was necessary to repack stuffing boxes monthly; considerable trouble was also experienced periodically with premature explosions due to formation of carbon. When the lubricating engineers of The Texas Company started their work in this plant the units were taken over for change in the internal lubrication only.

Texaco Ursa oil was installed for the lubrication of the stuffing boxes, cylinders and exhaust valves. In twelve months of operation with this oil the packing in the stuffing boxes has not been changed. In other words the packing is lasting at least twelve times as long.

No traces of carbon have been found in the cylinders or at the stuffing boxes during this time, and as a consequence the premature explosions have been entirely eliminated.

On account of the excellent results obtained from the use of Texaco Ursa Oil in the internal lubrication of the units, particularly as to the absence of carbon trouble and loss of packing, the chief engineer of the plant decided that he would try out the same oil throughout the lubricating systems of the units. Texaco Ursa Oil was, therefore, installed in the gravity circulating systems after this had been thoroughly cleaned out and cleared of all the old oil. Logs and other records, which have been kept all through this and previous operation of the units in question, show material reduction in cost of lubrication, as well as practical elimination of the principal troubles.

The log shows a saving of approximately 30 per cent over the condition obtaining prior to the introduction of Texaco Ursa Oil.

Basing the consumption upon engine hours, the records show a consumption for all lubrication of the units of 141 gallons of Texaco Ursa Oil for 544 hours of operation.

Of this, 51 gallons were used in the gravity circulating system and 90 gallons consumed for the lubrication of cylinders, stuffing boxes and exhaust valves.

The 30 per cent reduction in consumption, along with the elimination of the serious operating troubles, is an indication of the value of Texaco oil and service for this class of work.

FLASH AND FIRE TESTS AND THEIR VALUE IN SELECTING LUBRICATING OIL

A great deal has been written upon the subject of the flash and fire requirements of a lubricating oil. Theories have been advanced attempting to show the necessity for certain definite limitations along these lines, and as a consequence specifications have been written calling for certain flash tests in connection with lubricating oils for many purposes.

The flash point of an oil is the temperature at which sufficient vapor is formed, on the surface of the oil, to ignite on the application of flame. In order that the comparison be exact, the size of the vessel containing the oil, the size of the flame, its distance from the surface, and the general conditions surrounding the test must be the same.

The fire point of an oil is the point at which sufficient vapor is given off to burn continuously on the application of a flame.

Stated in this way, flash and fire tests seem very simple, and perhaps this is the reason for the use of all kinds of home-made apparatus for this purpose in manufacturing establishments using some classes of oil products.

There are a number of conditions, however, which will produce variation in the temperature at which an oil flashes, and unless a standard instrument is used and the test made in the standard way, the results of the test will not have any comparative value for the purpose of determining the way in which an oil will meet a specification.

A number of different instruments are made for this purpose, all of which, however, can be classed as either open cup or closed cup. In the instruments designated as open cup the liquid to be tested is placed in an open vessel and the flame passed over the surface at a definite distance from it. In the closed cup testers the whole operation takes place under cover. There is some variation between the different instruments as to the results obtained upon a given oil, and the variations occur in the use of the same instruments where the test methods are not exactly the same. There is a more important difference between the results obtained with an open cup and a closed cup instrument. Invariably the closed cup tester shows a flash of a lower temperature than the open cup, due to the smaller amount of air, and consequently the smaller amount of gas required to produce a mixture which will ignite. As a consequence of these variations it is necessary in giving the results of all flash tests to name the instrument in which the test was made as well as indicating whether it is open or closed cup.

For instance, if a petroleum spirit is required to flash at 100° F. in a New York State closed cup instrument this should be so stated. If it is not defined in this way the result obtained on another instrument of open cup design would give a different temperature reading for the same material.

The flash point is an important matter in connection with some of the lighter products made from petroleum. As these lighter products were the first products

manufactured from petroleum, and for many years the most important products, the flash and fire test came into general use during those years. The first commercial product made from petroleum was a burning oil for use in lamps. One of the important things in connection with the use of a burning oil is the degree of safety in its use. Consequently the flash point at which considerable vapor begins to come off and the fire point at which sufficient vapor is collected to burn continuously, had an important bearing upon the value of the kerosene for household and other illuminating purposes. Most of the states have adopted laws calling for a specific flash or fire point for kerosene in order to secure the proper margin of safety. Light petroleum products used in the manufacture of paint and varnish, for cleaning and other purposes, all require the specification of definite flash point from the standpoint of safety and advantage in their use.

It can readily be seen that with the general acceptance of flash and fire points as part of the necessary consideration of kerosene, and other light petroleum products, it was a natural thing that they should be quoted to a certain extent in connection with the lubricating oils when these were first manufactured. So it was discovered that certain lubricating oils having a definite flash and fire point were valuable for certain purposes, and as a consequence such oils were recommended. Undoubtedly this reasoning was logical so long as lubricating oils were all made from the same crude and the characteristics were the same. Under such circumstances any material difference between the analysis of one oil and another would indicate a difference in their value. When, however, lubricating oils began to be manufactured from different crudes with different characteristics, this reasoning could not be applied, and the value of the test was consequently diminished. The practice soon showed that oils varying considerably in flash and fire tests were doing satisfactory work under all ordinary mechanical conditions, and that the old comparison was of no value for the new conditions.

In the earlier days of lubricating experience with oils from petroleum products it was thought that it was necessary to have a high flash under superheat conditions in steam cylinders and under the high temperature conditions in internal combustion engines in order that the oil should be able to withstand the prevailing temperature. It has been definitely shown, however, of late that under some conditions of superheat and under all conditions in internal combustion engines, temperatures are reached which are higher than the flash or fire point of any oil which can be manufactured from petroleum products. In steam cylinder lubrication, experience with oils of varying flash point under the highest temperatures secured in this work, has shown very definitely and decidedly that there can be no vaporizing of a lubricating oil when it is discharged into a steam cylinder with the steam. Ample experimentation, testing and development work in the lubrication of internal combustion engines has shown that all oils are vaporized when they are brought into contact with the temperatures at the explosive point, so that the question resolves itself into a matter of lubricating under the ordinary temperatures and a mat-

ter of getting as nearly as possible complete vaporization for all oil which is at the point of explosion.

The only requirement for a lubricating oil from the standpoint of flash and fire is that it should be sufficiently above the average working temperature to give a proper margin of safety. As practically all bearings and other moving parts, with the exception of steam cylinders and the cylinders of internal combustion engines, are running at not more than 150° F., and practically no lubricating oils are offered on the market of less than 300° F. flash, the margin between the average working condition and the flash point is ample to take care of any contingency.

In steam cylinder lubrication, oils have been successfully used which vary so widely in flash point that there is evidently nothing in the conditions which would require a specification limiting this item. In fact, the practice in this regard has changed to such an extent within the last few years that the flash point can be disregarded in engine, machine oils and in steam cylinder lubrication entirely. Far more important is a correct diagnosis of the mechanical conditions of the work and the use of an oil which has been recommended with those mechanical conditions in mind.

In internal combustion engines of the explosive type, such as automobile engines, etc., the temperature in the compression chamber at the time of explosion will reach between 2000° and 3000° F., and the upper end of the cylinder and top of the piston reach as high as 500° F. This means that any oil in the compression chamber will be immediately vaporized by the heat of the explosion and the oil in the upper end of the cylinder will be either wholly or partially vaporized, where it touches the upper part of the piston. In addition to this, the question of leakage of gasoline into the crank-case is involved, as such leakage will have the effect of directly and rapidly lowering the flash point of the oil and thinning it out.

Obviously, these conditions do not call for a high flash oil, but rather for an oil of such a character that it will completely vaporize and pass out of the compression chamber with the exhaust gases, instead of partially vaporizing and forming a gummy deposit which will give a great deal of trouble by increasing the cylinder wear, valve leakage and causing pre-ignition. It so happens that oils with the lower flash point can be more completely vaporized in the compression chamber of an automobile motor than those having a high flash point with a consequence that less trouble from carbon deposit is experienced. Not long ago in connection with some work being done by one of our engineers in one of the large automobile factories, the engineers of the automobile factory insisted upon a high flash oil. In order to illustrate the conditions which obtain in the motor, some of the oil was put into a machine and the machine run about 100 miles, after which the oil was taken out and tested for flash point, with the result that the test showed a lowering of the flash point, from over 400° F. in the original oil to 150° F. in the oil in the crank-case at the end of the run. This filling of the crank-case was supposed to last 500 miles, indicating that for at least four-fifths of the time the motor would be lubricated by an oil of not over 150° F. flash.

All these things point to the conclusions arrived at by many of the users of oil; that the ability of a lubricating oil to meet the mechanical conditions does not depend upon a certain flash or fire test being secured. In many cases where a high flash oil was used some years ago a lower flash oil is being used today with better results, and the use of the flash tests in a specification merely limits the competitive advantage to the user of lubricating oil without giving him any valuable safety in connection with his work. The study of mechanical conditions alone makes it possible to recommend oils which are calculated to give the greatest lubricating efficiency, and only tests made under the mechanical conditions of work in the plant of the oil user indicate thoroughly the lubricating value of the oils recommended.

Neither gravity, which was discussed in the last issue, nor flash and fire have any bearing whatsoever upon the lubricating value of an oil, and their use is apt to be very misleading to the oil consumer because of this fact, and because their historic application in specifications, has been entirely discredited by the later work in the development of lubricating oils, for the various requirements of industrial use. The specification for flash and fire which originated many years ago was based on the commercial conditions of the oil manufactured, rather than any scientific value of the test for lubricating purposes. Oils which were first used for lubricating had certain flash and fire specifications, and these specifications were incorporated in the lubricating requirements of the user merely because such lubricating oils had been secured in the past. They have never been of value in determining lubricating efficiency and they are a distinct disadvantage to the user of lubricating oils today, because of their tendency to limit the supply to certain classes of oil, which may not after all be of much value for the purpose.

The only real test is the practical test. The only real demonstration is the demonstration in the shop, and the analysis which is of value to the engineer is the analysis which comes from his observation of the power requirement, the reduction of wear-and-tear, decreased consumption and the effect upon the friction load.

ONE YEAR OF TEXACO SERVICE IN A COAL PLANT

From One of Our Salesmen

On November 30th, 1914, the writer called on one of the largest operators in this territory. We were granted an interview by the General Manager and Purchasing Agent, and were informed that at that time they were under contract with one of our competitors, which contract would not expire until the following April.

However, they had experienced considerable trouble with their air compressors on account of improper lubrication of both steam and air cylinders and external parts. These troubles had been the subject of advice and suggestion by the company supplying the lubricants but the results had not corrected the difficulties. The General Manager granted permission for the writer to make an inspection of the air compressor to which he had reference, and the following was observed:

> Cross compound two-stage air compressors, Ingersoll-Rand manufacture, Imperial type; size, steam end 16x25x16", air end 13x22x16". Steam cylinder equipped with mechanical lubricator connected direct to steam chest, air cylinders equipped with mechanical lubricator connected to intake on air cylinders; air pressure 100 lbs. Air cylinders water jacketed. R. P. M. 180; external lubrication accomplished by splash. Compressors of the enclosed crank-case type; piston rod equipped with double stuffing boxes on the steam end.

"The oil in the crank-case was badly emulsified and the engineer stated that it was necessary to change same every three days. The steam cylinder oil was being used excessively. It was stated that this was necessary, as the compressors are of a variable speed, and in order to prevent groaning in the cylinders the excessive rate of feed was maintained. The air cylinder oil was being used excessively, the oil in use being of low grade, not having sufficient body to withstand the temperature in the air cylinders and keep the metallic surfaces apart. The boiler feed water containing sulphuric acid required the constant use of strong alkali boiler compounds in order to prevent pitting in the boiler tubes and shell, the excess alkali causing foaming of boiler water into steam lines; as the distance from the boiler house to engine room was approximately six hundred feet and there were no separators in the steam lines, considerable condensation occurred. The stuffing boxes on the piston rods were of the soft packing type, the rods being badly cut and worn to such an extent as to allow the condensation (containing strong alkali solution) and steam cylinder oil (containing tallow) to continually enter the crank-case, this condition being responsible for the emulsified oil in the crank-case. The steam cylinder oil in use was of a heavy

viscous cylinder stock, containing a low percentage of compound, and would not atomize before entering the steam cylinders, necessitating an excessive feed. Owing to the small percentage of compound in the oil it would not withstand the condensation.

"After making an inspection of the equipment, made the following recommendations:

First—that the boiler feed water be tested out by a reliable chemist, who would determine the quantity of alkali necessary to neutralize the present feed water and overcome chemical action in the boilers without carrying an excessive amount of alkali in the boilers.

Second—that the air compressor rods be turned down in a lathe and fitted with metallic packing stuffing boxes on the steam cylinders, which would prevent the condensation from entering the crank-cases and emulsifying the oil.

Third—that the present lubricator piping on the steam cylinders be extended 6 feet above the steam chest and feed pipes extended into the center of the steam headers in order to obtain thorough atomization of the oil before entering the steam chest.

Fourth—that an air compressor oil be used, an oil of a heavier body than the oil in use at that time, the oil to be straight run, highly filtered and manufactured for the purpose, as an oil of this character could be used with a minimum feed and minimum carbon deposit, and efficient lubrication obtained.

After considering these suggestions the management requested the writer to recommend Texaco lubricants that would lubricate the air compressors, as he was willing to give us a trial order, and would carry out the recommendations previously made.

Texaco Olympian Cylinder Oil was recommended for steam cylinder lubrication, Texaco Canopus Oil for the external lubrication of the air compressors, and Texaco Algol Oil for the air cylinder lubrication.

The changes suggested were carried out to the letter, rectifying considerable boiler trouble, as no foaming has been experienced since the proper proportioning of the boiler compound has been followed. The emulsifying of the oil in the crank-case has been rectified, and the crank-case is now cleaned out every *six months* instead of every *three days*. The cost of the steam cylinder lubrication has been reduced 15%, perfect atomization of the steam cylinder oil is now obtained and groaning in the steam cylinders is a thing of the past. The cost for air cylinder lubrication has been reduced 5%, notwithstanding that Texaco Algol Oil is very much higher in price than the oil originally used, and carbon trouble and sticking valves entirely eliminated.

It is a pleasure to note that the above company are still regular customers and are well satisfied with Texaco products and Texaco service to the extent that they do not hesitate telling other operators in this district what has been done for them by The Texas Company.

Your Slant

We have it—

ONE of the factors which contributes to the success of TEXACO LUBRICANTS is the way in which our organization is able to get the consumer's viewpoint.

In the first place we are extensive users of power ourselves.

We operate a large number of powerful pumping stations along our miles of pipe line.

Our works include can factories, coopershops, case-making plants, machine shops, besides locomotives, hoists, motor trucks, and in addition to this we operate a large fleet of tugs and ocean-going vessels.

So we get first-hand lubricating experience with steam, gas and electric prime-movers as well as various kinds of machinery.

Second—our field representatives are in daily contact with the performance of TEXACO LUBRICANTS in plants and shops of all kinds, observing, testing and comparing.

The information thus gained is behind the TEXACO Line and is reflected in our ability to give you the right oil in the right place.

THE TEXAS COMPANY

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